REMARKS

Claims 1-9, 13 and 20 have been canceled, and Claims 10-12 rewritten to more definitely set forth the invention and obviate the rejections. Support for the amendment of Claims 10-12 can be found in the Specification from page 19, last line, to page 22, line 13, page 23, line 21, to page 24, line 12, page 25, line 18, to page 26, line 19, page 27, lines 12 to 24, page 32, line 1, to page 33, line 9, page 34, lines 1 and 2, and in the drawings in Figures 2(a)-5(c) and 10(a)-(d). The present amendment is deemed not to introduce new matter. Claims 10-12 and 14-19 remain in the application, claims 14-19 having been previously withdrawn from prosecution.

Reconsideration is respectfully requested of the rejection of Claims 10, 11 and 13 under 35 U.S.C. 103(a) as being unpatentable over De Ryck (U.S. Patent No. 3,448,490).

The cited De Ryck reference discloses an installation for the injection molding of a shoe sole in a mould closed by a last. In particular, De Ryck provides an "injection head, a series of molds", and "means imparting an intermittent movement to the molds, so that each mold is sequentially located in front of the injection head and means actuating an injection mechanism which is connected to the injection head every time a mold is placed in front of the injection head.

Specifically, as shown in Figure 2, and as illustrated in the drawing shown in the attached Appendix A, the molds are carried by individual trolleys which run on rails and which may be switched from a main track to an alternate track to effect repairs, changes of molds, etc." (see column 1, lines 32-41). Resin is injected into the molds, one by one, as the molds themselves move around the track. Importantly, it should be noted that each cavity is filled using

one injection of molten resin through one gate.

In contrast, the present invention provides an injection molding method comprising moving an injection portion along a line of a plurality of resin supplying ports in communication with a cavity, while injecting molten resin from the injection portion into the resin supplying ports, so as to supply the molten resin to the cavity, wherein the molten resin is sequentially injected into the resin supplying ports *at a low injection pressure* by moving the injection portion from one resin supplying port to the next resin supplying port, thereby injecting molten resin to all the resin supplying ports in a sequential manner. Further, as claimed in now amended claim 11 herein, the present invention provides that, during injection of the molten resin into the cavity, the injection portion is moved from a resin supplying port disposed at a low elevation end of the line of a plurality of resin supplying ports to a resin supplying port disposed at an upper elevation end of the plurality of resin supplying ports, which are arranged in a vertical direction.

It is an object of the present invention to provide a method for injection molding that requires only one injection head, enables the use of fairly lightweight molds, and which, consequently, enables the use of inexpensive injection molding equipment. Further, it is an object of the present invention to provide an injection molding method in which high injection pressure is not required (i.e., is performed at a *low injection pressure*), by using several gates for sequential resin injection, and which thus allows the use of very large and/or long mold cavities. The injection molding method of the present invention, as described above, achieves same by providing a method of timed, sequential injection molding at low injection pressures and low mold clamping forces.

"Since the resin injected from the next resin supplying port has a high temperature, the resin beginning to solidify within the cavity is molten a little by the injection of the hot resin into the cavity. The resin beginning to solidify and the hot resin are mixed so as to be cooled and solidified, whereby the resins can be bonded. As a result, it is possible to lower the injection pressure and mold clamping force" (see Specification, page 10, lines 3-9).

In particular, as illustrated in the attached illustrative drawing (not meant to be a formal drawing herein) in Appendix A, the method of the present invention calls for an injection portion (an injection head) to inject molten resin into a mold cavity having a plurality of gates for resin injection, by having one injection head move from gate to gate in a sequential manner to complete the injection process. Preferably, as called for in claim 11, the mold cavity is inclined in a vertical direction, and the injection molding process of the presently claimed method is begun at a resin supplying port disposed at a low elevation end (i.e., the end of the mold cavity disposed at the lowest level in respect to the ground). The molten resin is then injected into the resin supplying ports, so as to fill the resin in the mold cavity up to a charge level below the next highest resin supplying port.

When the charge level within the mold cavity reaches a desired level, injection is terminated at the resin supplying port disposed at the low elevation end, the resin injection portion (resin injection head) is moved to the next highest resin supplying port, and molten resin is injected into said next highest resin supplying port.

The Examiner has argued, on page 7, last paragraph, and on page 8, first paragraph, of the instant Office Action, that it would have been obvious to make the injection portion movable and

the resin ports stationary in De Ryck's molding process in order to accommodate a heavier mold that would be hard to move. However, as discussed above, the object of the present invention is exactly contrary to such object. Specifically, it is an object of the present invention to provide a method of injection molding that enables the use of *lighter*, and consequently less expensive, molds, by enabling the injection molding to be carried out sequentially at lower mold pressures and lower mold clamping forces.

The present invention achieves same by sequentially injecting the molten resin through a series of injection supplying ports into a mold disposed in a vertical disposition (i.e., with a first end at a lower level than a second end) *at a low injection pressure*, wherein the molten resin is injected into the mold cavity through the injection supplying port located at the lowest elevation first, up to a certain charging level, and allowed to fill the cavity using pressure assisted by gravitational forces. Then, as claimed in now amended claim 11, when the charging amount of the molten resin reaches a certain level (i.e., a charging level sufficient to fill the lowest end of the mold cavity), the injection portion is moved to the next highest resin supplying port, and so on.

As the Examiner has recognized, DeRyck simply discloses a method of quick injection molding of conventional, heavy mold cavities, using a single injection process, by utilizing a conveyor belt-type apparatus for movement of the molds. Accordingly, It is believed that the cited DeRyck reference fails to teach or suggest the injection molding method of the present invention, which utilizes sequential injection molding at low injection pressures and low molding clamping forces, to produce high quality large or long molded objects. Withdrawal of the

rejection is accordingly respectfully requested.

Reconsideration is respectfully requested of the rejection of claim 12 under 35 U.S.C. 103(a) as being unpatentable over De Ryck, in view of Keller.

The cited De Ryck reference is discussed above in detail.

The cited Keller, et al. reference discloses a structural article (injection molded article) of relatively large dimensions, such as automobile body parts, having elongated ribs therein for channeling of gas and for strengthening the final product. Further, a method of producing such structural articles is disclosed, involving injection molding utilizing "sequential gating of the molten thermoplastic resin in the mold *and the use of a gas to assist to distribute the molten thermoplastic resin within the mold cavity*" (see column 3, lines 62-64).

Although, as the Examiner has mentioned, Keller, et al. utilizes pressure sensors provided in a predetermined portion of said cavity for detecting a charging amount of molten resin, "[t]he mold halves 24 and 26 are closed and clamped together through a substantial clamping force with conventional clamps" (see column 6, lines 37-38). "Molten thermoplastic resin under high pressure is extruded from an extruder 76 into the distribution channel" (see column 6, lines 38-40). "The sequencing of the gates for the molten thermoplastic resin provides a continuous flow of resin throughout the mold without interfacing of two or more wave fronts of molten thermoplastic resin" (column 7, lines 42-46).

In contrast, as discussed above, the injection molding method of the present invention provides sequential injection of molten resin into a mold cavity at a plurality of resin supplying ports *at low injection pressures and with low mold clamping forces*. Further, unlike Keller, et al.

the present invention does not utilize gas pressurized at high pressures to push the molten resin throughout the mold. Rather, the mold cavity is inclined in a vertical manner, so as to also utilize gravitational forces to push the molten resin down into the mold cavity.

Moreover, unlike Keller, et al., who calls for "a continuous flow of resin throughout the mold without interfacing of two or more wave fronts of molten thermoplastic resin" (column 7, lines 42-46), "[s]ince the resin injected from the next resin supplying port has a high temperature, the resin beginning to solidify within the cavity is molten a little by the injection of the hot resin into the cavity. The resin beginning to solidify and the hot resin are mixed so as to be cooled and solidified, whereby the resins can be bonded. As a result, it is possible to lower the injection pressure and the mold clamping force" (see Specification, page 10, lines 3-9).

In view of the deficiencies of both DeRyck and Keller, et al., as discussed above, as well as the amendments to claim 12 herein, it is believed that the Examiner would now be justified in no longer maintaining the rejection. Withdrawal of the rejection is accordingly respectfully requested.

In view of the foregoing, it is respectfully submitted that the application is now in condition for allowance, and early action and allowance thereof is accordingly respectfully requested. In the event there is any reason why the application cannot be allowed at the present time, it is respectfully requested that the Examiner contact the undersigned at the number listed below to resolve any problems.

Respectfully submitted,

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CERTIFICATE OF MAILING

I hereby certify that this Amendment in patent application Serial No. 10/632,844, is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on June 12, 2006.

Donald E. Townsend, Jr.

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